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BIOLOGICAL EVALUATION

EFFECT OF PRECOMMERCIAL THINNING ON A YOUNG STAND OF PONDEROSA PINE *PINUS PONDEROSA*, INFECTED WITH *ARMILLARIA MELLEA*

U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
Division of Timber Management
Region 6
Portland, Oregon

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Root Disease

EFFECT OF PRECOMMERCIAL THINNING ON PONDEROSA PINE, PINUS PONDEROSA, INFECTED WITH ARMILLARIA MELLEA

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ABSTRACT

Mortality of potential crop trees from Armillaria root rot in thinned plots within an infected ponderosa pine stand in eastern Oregon was 4.8% seven years after treatment compared with 8.9% for nonthinned plots. Land managers should not defer thinning stands needing treatment because of the presence of the fungus.

Plant Dis. Reptr. 59: 308-309.

Armillaria root rot incited by Armillaria mellea (Vahl) Quél. is an important root disease of many tree species throughout the world (2). Trees in all vigor classes are affected, but infection appears to be greatest in trees of low vigor. Impact from the disease is expected to increase on poor sites and in nonindigenous tree plantings in Oregon and Washington (1).

A disease survey, 1969-1971, of forest conifer plantations on National Forest land in Oregon and Washington indicated that Armillaria root rot is the most common and widely distributed root disease in plantings (1). Tree mortality usually was confined to a small number of trees in each infected plantation. In most instances, the affected trees appeared to be under stress. This suggests the possibility of reducing the susceptibility of stands to Armillaria root rot by thinning, thereby increasing the vigor of remaining trees.

The purpose of this continuing study is to determine the effects of precommercial thinning on the spread and intensification of A. mellea in a stand of ponderosa pine, Pinus ponderosa. Land managers need this information to determine the priority of units for thinning operations.

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EFFECT OF PRECOMMERCIAL THINNING ON A YOUNG STAND OF PONDEROSA PINE, PINUS PONDEROSA, INFECTED WITH ARMILLARIA MELLEA

By

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Introduction

Armillaria root rot incited by Armillaria mellea (Vahl) Quel. is an important root disease of many tree species throughout the world (Raabe, 1962). Trees in all vigor classes are affected, but infection appears to be greatest in trees of low vigor.

A survey of diseases in plantations conducted in Oregon and Washington during 1969 to 1971 indicated that Armillaria root rot was the most common and widely distributed root disease in the region. Tree mortality was usually confined to a small number of trees in each infected plantation. In most instances, the affected trees appeared to be under stress. The impact from the disease is expected to increase in areas of poor site and where non-native trees have been planted (Dolph and Hadfield, 1971).

Occasionally A. mellea becomes very pathogenic, killing large numbers of trees over a large area. Several sites of intense disease activity have been located in Oregon and Washington. A possible explanation for observed differences in pathogenicity of the fungus within the region may be the presence of different clones of A. mellea. Variation in virulence and pathogenicity of geographic isolates has been demonstrated by other workers (Benton and Ehrlich, 1941; Raabe, 1967; Wilbur, et al., 1972).

The purpose of this continuing study is to determine the effects, if any, of silvicultural treatments on the spread and intensification of A. mellea in a stand of ponderosa pine, Pinus ponderosa.

During May 1966, a series of study plots was established in a young stand of ponderosa pine (saplings and poles) infected with A. mellea. The stand is located near Garrison Butte on the Sisters Ranger District, Deschutes National Forest, Oregon. The soil in this area is a thin, rocky, pumice of low organic content. The major vegetation consists of ponderosa pine; western juniper, Juniperus occidentalis; ceanothus, Ceanothus velutinus; manzanita, Arctostaphylos spp.; and bitterbrush, Purshia tridentata.

Materials and Methods

Two blocks of ponderosa pine each approximately eight acres in area were marked for a precommercial thinning during May and June 1966. Potential crop trees were marked for leave on the entire area, even though one-half of the study area was to remain non-thinned. Within each block four ¼-acre plots were randomly selected. One-half of these plots were to be thinned; one-half non-thinned. A total of eight plots were established; four in units to be thinned and four in units left non-thinned.

Each plot (104.4 feet square) was further subdivided into six transects (17.4 feet wide and 104.4 feet long). Plot and transect corners were designated by wooden stakes and metal rods to aid in their relocation during subsequent visits (Figure 1).

Leave trees (crop trees) and Armillaria-killed or obviously infected trees three feet or more in height were stem-mapped by transects. Dead and dying trees were inspected for signs and symptoms of A. mellea: the presence of resinosis at the base of the stem, mycelial fans under the bark and rhizomorphs. Trees within a twelve-foot-wide buffer zone around the plot boundaries were also stem-mapped.

Precommercial thinning (spacing approximately 15 feet by 15 feet) was done on the area designated for thinning during June 1966 after all preliminary data had been gathered.

Reexaminations at intervals of one to two years involved tallying Armillaria-killed trees within each treatment.

Results and Discussion

The plots designated to be thinned and non-thinned were similar in numbers of leave crop trees at the time of original plot establishment, 207 and 203, respectively (Table 1). Numbers of Armillaria-infected trees were also similar; thinned plots contained 570 trees, non-thinned plots, 623 trees (Table 1).

Armillaria was also noted on juniper and ceanothus (Tarry and Shaw, 1966) during this study, but not included in the final data.

Data collected from 1967 to 1973 on all plots showed that cumulative Armillaria-caused mortality in thinned plots was 7 crop trees (17 non-crop trees) compared with 17 crop trees (223 non-crop trees) in non-thinned plots (Table 1). Data for each transect are presented in Tables 2 and 3.

Two crop trees were lost to Ips spp. beetles, one in each treatment.

Within a period of 7 years, Armillaria root rot has caused the loss of almost 9 percent of the designated crop trees in the non-thinned plots compared with 4 percent in the thinned plots. In both treatments the disease appears to be intensifying (Figures 2 and 3). The rate of increase has been delayed by thinning; however, it would be premature to assume that thinning to the specifications used in this study would serve as a suitable control measure in similar stands. Observations of these study plots will continue to be made on a yearly basis.

Literature Cited

Benton, V.L. and J. Ehrlich. 1941. Variation in culture of several isolates of Armillaria mellea from western white pine. Phytopathology 31: 803-811.

Dolph, R.E. and J.S. Hadfield. 1971. Forest pest conditions in the Pacific Northwest 1971. U.S. Forest Service, Insect and Disease Control Branch. December 1971. 15 p.

Raabe, R.D. 1967. Variation in pathogenicity and virulence in Armillaria mellea. Phytopathology 57: 73-75.

Raabe, R.D. 1962. Host list of the root rot fungus, Armillaria mellea. Hilgardia 33(2): 25-88.

Tarry, J.C. and C. G. Shaw. 1966. Association of Armillaria mellea with the dieback of Ceanothus in the Pacific Northwest. Plant Dis. Reptr. 50: 399-400.

Wilbur, W., D.E. Munnecke, and E.F. Darley. 1972. Seasonal development of Armillaria root rot of peach as influenced by fungal isolates. Phytopathology 62: 567-570.

FIGURE 1. ARMILLARIA STUDY PLOT LAYOUT

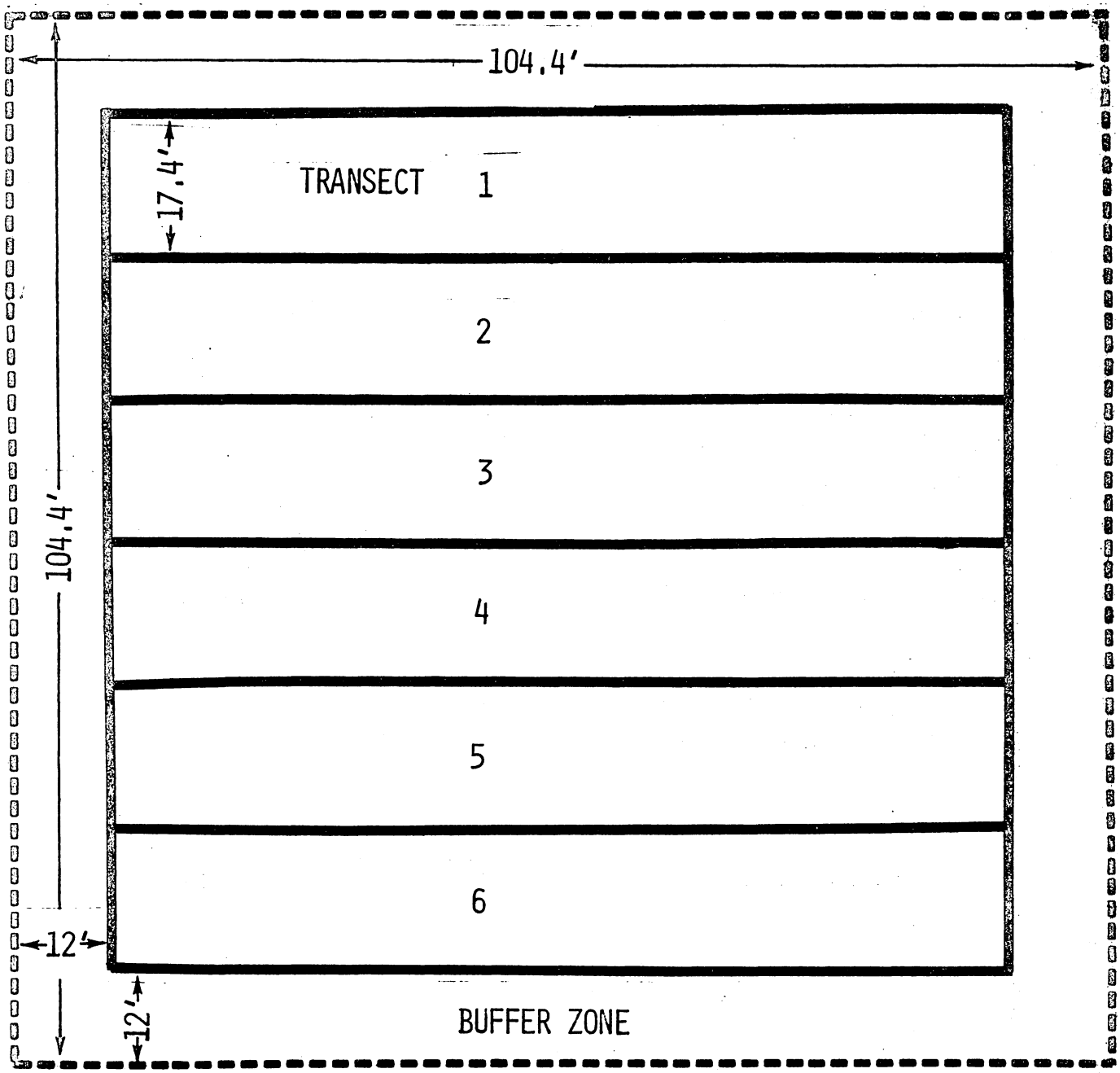

Table 1.--Annual Loss of Crop and Non-crop Trees to Armillaria Root Rot in Non-Thinned and Thinned Plots, Garrison Butte, Sisters, Oregon.

	Non-crop trees killed by year. Crop trees killed ( ).							
Treatment	Crop trees[1/]	1966[2/]	1967	1968	1969	1972	1973	Total
Non-thinned	203	623 (1)	35 (5)	33 (2)	25 (5)	69 (4)	61 (1)	846 (18)
Thinned	207	570 (1)	3	0	0 (1)	5 (3)	9 (3)	587 (8)
TOTAL	410	1193 (2)	38 (5)	33 (2)	25 (6)	74 (7)	70 (4)	1433 (26)

1/ No. of crop trees at beginning of study.

2/ Includes all trees killed by A. mellea at time of plot establishment

Table 2.--Annual Loss of Crop and Non-crop Trees to Armillaria Root Rot in Non-thinned Plots by Transect, Garrison Butte, Sisters, Oregon.

Unit No. Plot No. (¼-acre area)	Transect	Crop trees 1/	Non-crop trees killed by year. Figures in ( ) designate crop trees.						Totals
			1966 2/	1967	1968	1969	1972	1973	
1A-1	1	8	39	2	1	1	3	3	49
	2	9	45	2	2	2	9 (1)	9	69 (1)
	3	11	30	1	3	3 (1)	6 (1)	2	45 (2)
	4	8	38	1 (1)	0	0	1	4 (1)	44 (2)
	5	12	73	0	1 (1)	1 (1)	5	3	83 (2)
	6	14	29	3 (1)	1	1	3 (2)	1	38 (3)
Total		62	254	9 (2)	8 (1)	8 (2)	27 (4)	22 (1)	328 (10)
1A-2	1	5	29	4	1	1	2	2	39
	2	5	16	2	1	2	3	2	26
	3	5	17	0	0	0	0	0	17
	4	6	9	1	1	0	0	0	11
	5	5	1	0	1	2	3	2	9
	6	6	2	0	1 (1)	0 (1)	0	1	4 (2)
Total		32	74	7	5 (1)	5 (1)	8	7	106 (2)
2A-1	1	5	36	2	3	1	2	0	44
	2	8	29	4	2	3 (1)	6	2	46 (1)
	3	9	26	0	1	0 (1)	1	4	32 (1)
	4	11	27	2	0	0	5	5	39
	5	9	17	0	3	1	3	2	26
	6	11	29	3 (2)	0	0	4	2	38 (2)
Total		53	164	11 (2)	9	5 (2)	21	15	225 (4)
2A-2	1	10	49	3	1	1	5	4	63
	2	10	13	1	0	0	0	1	15
	3	5	12	1	0	0	0	0	13
	4	12	18 (1)	2 (1)	2	3	1	7	33
	5	10	25	1	7	2	5	5	45
	6	9	14	0	1	1	2	0	18
Total		56	131 (1)	8 (1)	11	7	13	17	187 (2)
GRAND TOTAL		203	623 (1)	35 (5)	33 (2)	25 (5)	69 (4)	61 (1)	846 (18)

1/ No. of crop trees at beginning of study.

2/ Includes all trees killed by A. mellea at time of plot establishment.

Table 3.--Annual Loss of Crop and Non-crop Trees to Armillaria Root Rot in Thinned Plots by transect, Garrison Butte, Sisters, Oregon.

Unit No. Plot No. (¼-acre area)	Transect	Crop trees[1]	Non-crop trees killed by year. Figures in ( ) designate crop trees.						Totals
			1966[2]	1967	1968	1969	1972	1973	
1B-1	1	5	60	0	0	0	0	0	60
	2	8	65	0	0	0	0	1	66
	3	7	27	0	0	0	0	0	27
	4	8	44	0	0	0	0	0	44
	5	7	18	0	0	0	0	0	18
	6	5	14	0	0	0	0	0	14
Total		40	228	0	0	0	0	1	229 (0)
1B-2	1	10	17	0	0	0	0	0	17
	2	9	19 (1)	0	0	0	0	1	20 (1)
	3	12	5	0	0	0	1	1	7
	4	8	2	0	0	0	0	3	5
	5	9	17	0	0	0	0	1	18
	6	13	20	0	0	0	1	0	21
Total		61	80 (1)	0	0	0	2	6	88 (1)
2B-1	1	7	5	0	0	0	0	1 (1)	6 (1)
	2	11	50	0	0	0	1 (1)	0	51 (1)
	3	8	44	0	0	0	1	0	45
	4	11	21	0	0	0	0	0	21
	5	11	2	3	0	0	0	0	5
	6	9	9	0	0	0	0 (1)	0	9 (1)
Total		57	131	3	0	0	2 (2)	1 (1)	137 (3)
2B-2	1	11	43	0	0	0	0	0 (1)	43 (1)
	2	9	12	0	0	0	0	0	12
	3	7	13	0	0	0	0	0	13
	4	9	19	0	0	0 (1)	0 (1)	1 (1)	20 (3)
	5	6	19	0	0	0	1	0	20
	6	7	25	0	0	0	0	0	25
Total		49	131	0	0	0 (1)	1 (1)	1 (2)	133 (4)
GRAND TOTAL		207	570 (1)	3	0	0 (1)	5 (3)	9 (3)	587 (8)

1/ No. of crop trees at beginning of study.

2/ Includes all trees killed by A. mellea at time of plot establishment.

FIGURE 2.

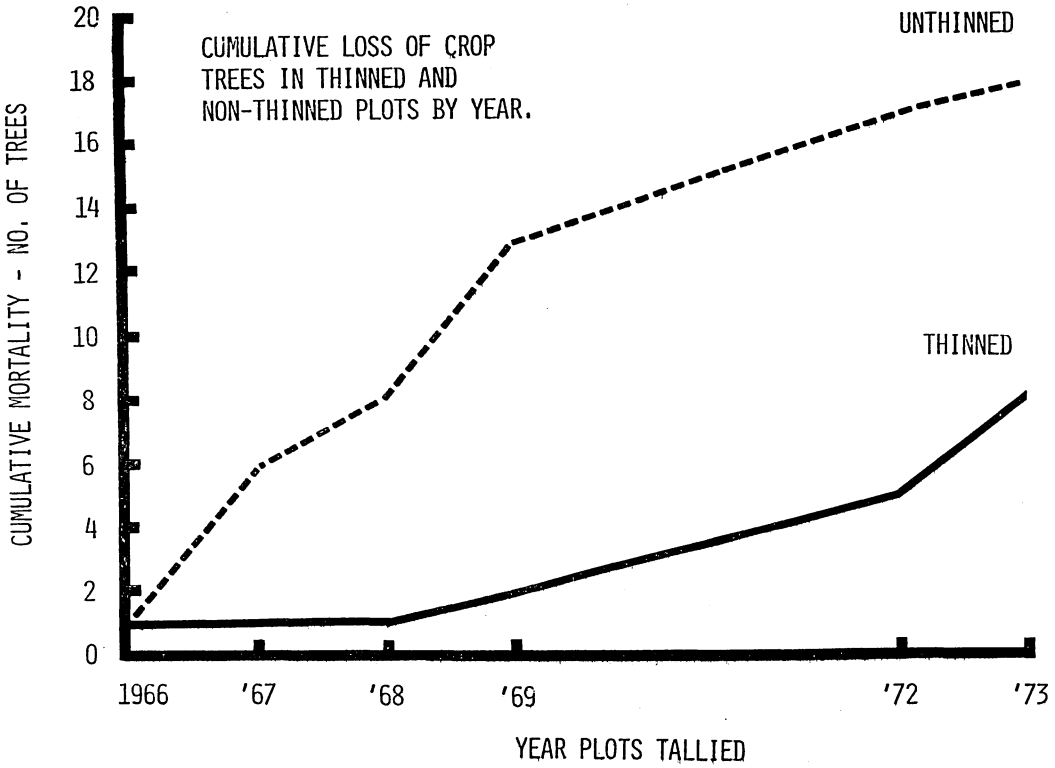

FIGURE 3.